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ABSTRACT

Results of the 1982-1983 Graduate Student Survey of physics and astronomy graduates in the United States are presented. Information is provided on the educational background, current graduate student status, choice of subfield, and employment prospects. Highlights include the following findings: an increase occurred in the proportion of foreign students among the physics doctorate recipients; an increase occurred in theoreticians among the advanced graduate physics students; and starting salaries for doctorate and terminal master's degree recipients increased 3 percent and 5 percent, respectively. Information is included on the following student characteristics for the total graduate population and separately for minority group students: sex, citizenship, professional society membership, major of bachelor's degree, type of bachelor's institution, type of graduate institution, full- or part-time attendance, and sources of financial support. Additional tables include: number of advanced graduate physics students specializing in selected experimental or theoretical subfields by years of graduate study completed; employment of doctoral graduates by citizenship; use of physics in potentially permanent employment of graduate degree recipients; and graduate astronomy students by subfield and years of graduate study. (SW)

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1982-83

GRADUATE STUDENT SURVEY

by Susanne D. Ellis AIP Pub. No. R-207.16 July 1984

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1982–83
GRADUATE STUDENT SURVEY

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In the early 1960's when the Graduate Student Survey was first published the number of graduate physics students had just passed the ten-thousand mark as four thousand new students enrolled each year. Twenty years later the graduate physics enrollment has again reached ten thousand, but fewer than three-thousand new physics students begin graduate study each year. The Graduate Student Survey is conducted annually so as to call attention to changes in the characteristics of the graduate student population. Almost ten years ago graduate astronomy students were included in the survey. In gathering these data we request each graduate student to contribute information on his or her educational background, the current graduate student status, choice of subfield and employment prospects where applicable. The highlights of this report are:

→ an increase in the proportion of foreign students among the physics doctorate recipients.

→ an increase in theoreticians among the advanced graduate physics students.

→ a modest rise in starting salaries for doctorate and terminal master's degree recipients of 3% and 5% respectively.

In an attempt to measure the demand for new physicists, we monitor the employment offers received by each graduate physics degree recipient. For the class of 1983 little change from previous years could be observed. **Figures I** and **II** present five year trends of employment offers for each group of graduates and divide the offers into three categories: no offer, one offer and multiple offers. Between 1979 and 1983 as shown in **Figure I** at most 6% of the physics doctorate recipients reported no job offers immediately following graduation, while a majority of the remaining graduates received multiple offers to choose from. **Figure II** focuses on employment offers for new physics masters for whom the demand is not as great. Between 11% and 16% of the graduates in recent years reported no job offers upon graduation and only one-third of the masters received multiple offers to choose from.

Fig. I. Employment offers for new physics doctorate recipients, 1978–1983.

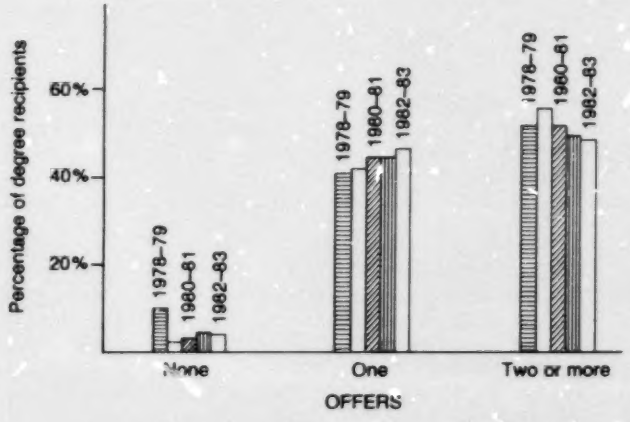


Fig. II. Employment offers for new physics masters 1978–83.

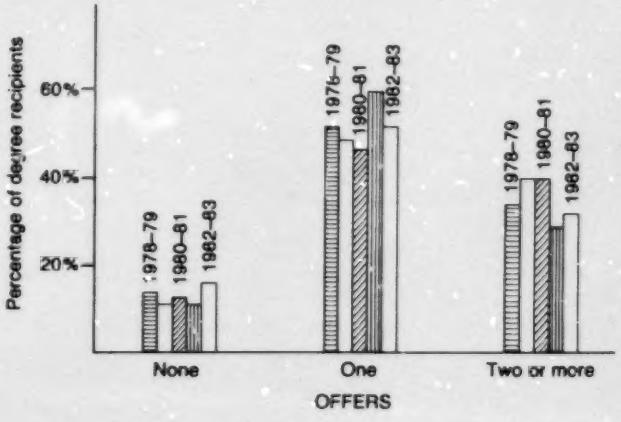


Table I. Characteristics of the graduate physics student population, 1982–83.

Characteristics		All graduate students	First-year graduate students	Degree recipients: Terminal masters	Doctorate recipients
	*Total population: Number of respondents	10 429 6 442	2 630 1 267	625 210	921 567
Sex	Female	11%	12%	13%	7%
	Male	89	88	87	93
Citizenship	U.S.	67%	60%	83%	73%
	Foreign	33	40	17	27
Professional society membership	Yes	36%	14%	19%	53%
	No	50	64	52	29
	No response	14	22	29	16
Major of bachelor's degree	Physics	89%	87%	86%	92%
	Mathematics	3	3	5	2
	Engineering	4	5	2	2
	Other	4	5	7	4
Type of bachelor's institution	PhD-granting	46%	42%	45%	54%
	MS-granting	8	8	17	3
	BS/BA granting	19	15	22	21
	Foreign	27	35	16	22
*Type of graduate institution	PhD-granting	91%	87%	75%	100%
	MS-granting	9	13	25	—
*Student status	Full-time	89%	89%	76%	88%
	Part-time	11	11	24	12
Source of support	Teaching assistantship	36%	56%	45%	8%
	Research assistantship	42	14	18	70
	Fellowship	9	11	4	6
	Employment	3	4	7	4
	Family, savings, loan	3	5	9	4
	Other	7	10	17	8

*These data were derived from the Survey of Enrollments and Degrees.

Table I presents eight characteristics of the total graduate physics student population as well as those of three subgroups, namely the first-year students, the terminal masters and the doctorate recipients. The total population in each of these groups is provided by our Survey of Enrollments and Degrees. Thus the first two lines of **Table I** indicate the response patterns for each of the four groups.

The proportion of women among the graduate physics students has changed only very gradually in recent years. For example in the mid to late 1970's women comprised approximately 8% of all physics students compared with 11% in 1982–83. On the other hand, the characteristic that indicates the greatest annual changes recently is citizenship. One-third of all graduate physics students are foreign citizens and at the first-year level they constitute 40%. Foreign doctorate recipients in the class of 1983 indicate a three percentage-point increase over the previous year to 27%. This sudden change can be linked to the year 1978 when the rising trend of foreign graduate students began.

The question on membership in a professional society shows that a majority of doctoral graduates are members, but only one-third of all graduate students, and very few (14%) of the entry-level students join a professional society.

Close to 90% of the graduate physics students first majored in physics when they were undergraduates. The fourth characteristic presented in **Table I** substantiates that statement and lists two other, but closely related, majors which potential physicists had chosen as undergraduates.

Other characteristics such as the distribution of sources of support show little change from previous years. While physics is generally studied on a full-time basis, terminal master's degree candidates form the exception by including 25% part-time students.

The total number of survey respondents who identify themselves as members of a specific minority is close to 1800 or 28% of all respondents. It is important to note that approximately 85% of these students are foreign citizens. **Table II** lists the minority groups and divides the larger ones on the basis of citizenship. The last two rows of **Table II** indicate the number of degree recipients in each minority group for the academic year 1982–83. These numbers should be treated as lower limits because they represent individual respondents to a survey whose overall response is 61%. Black degree recipients are the exception because physics department chairpersons are

Table II. Characteristics of minority group physics students, 1982–83.

Characteristic		Total number:	Black U.S.	Black Foreign	American Indian	Hispanic Puerto Rican	Hispanic Mexican American	Hispanic Other U.S.	Hispanic Other Foreign	Asian Indian	Oriental U.S.	Oriental Foreign	Arab
			46	32	9	17	11	23	144	351	87	847	210
Sex		Female	7	2	1	2	2	1	10	68	16	123	27
		Male	39	30	8	15	9	22	134	283	71	724	183
Candidacy for:		TMS	11	7	–	2	2	4	14	18	9	49	16
		MS and PhD	24	21	8	7	6	13	70	235	53	444	138
		PhD only	11	4	1	8	3	6	60	98	25	354	56
Student status		Full-time	39	30	7	13	8	20	141	346	78	823	192
		Part-time	7	2	2	4	3	3	3	5	9	24	18
Prof'l society membership		APS	9	6	3	3	–	5	36	104	31	144	44
		Other society	1	–	1	–	1	2	103	3	4	14	7
		None	36	26	5	14	10	16	5	244	52	689	159
Full-time equivalent years of graduate study		<1	8	11	2	–	3	4	28	68	18	225	36
		2	16	10	1	10	2	7	27	66	12	215	40
		3	4	5	2	1	1	5	27	62	14	138	34
		4	5	3	–	1	1	2	22	51	8	86	32
		5	2	1	1	3	3	–	20	37	14	85	32
		>6	11	2	3	2	1	5	20	67	21	98	36
Major subfields		Elect. at. mol.	5	2	2	–	1	1	7	30	4	49	17
		Elem. particles	4	–	3	1	2	3	27	47	8	87	20
		Math. physics	3	3	1	1	1	1	27	31	6	43	11
		Nuclear	3	2	–	2	–	3	10	37	3	55	30
		Solid state	8	13	–	9	4	8	40	119	34	349	75
Graduate degree recipients		TMS	10	3	–	–	1	2	4	7	12	20	8
		Doctorates	13	4	3	1	1	4	12	38	24	17	20

asked to report the numbers of black graduates as part of the Survey of Enrollments and Degrees thereby improving the accuracy of those totals.

Despite the substantial variations in the sizes of minority groups the six characteristics presented in **Table II** show few differences from those of the entire graduate physics population. However the exceptions are sex and student status. Most of the minority groups include higher proportions of women than the 11% indicated for all graduate students in **Table I.** And part-time students, which also comprise 11% of the total, make up only 3% among foreign minorities, but as much as 15% among U.S. minorities.

The data in **Table III** were scaled up to give an estimate of the total number of graduate physics students in each of the major subfields and at nine levels of graduate study. One reason for presenting this type of analysis is to make it possible to estimate the number of graduates in a given subfield who will seek employment within a year or two. The median number of years of graduate study spent to complete a physics doctorate is between five and six. Another function of **Table III** is that it indicates which subfields are likely to require more time to complete a dissertation; electron, atomic or molecular physics appears to be an example of such a specialty. In a comparison with the previous year, the distribution of graduate students among the subfields is very similar.

Table III. Number of graduate physics students, by subfield and years of graduate study completed, 1982–83.

		Full-time equivalent years of graduate study <1 yr.	2 yrs.	3 yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.	>9 yrs	Total graduate students N	%
Distribution* of students	N	2630	2126	1606	1230	1158	866	470	177	166	10 429**	
	%	25.2	20.4	15.4	11.8	11.1	8.3	4.5	1.7	1.6		100.0
Astrophysics		111	79	90	51	63	52	21	15	8	490	4.7
Bio/medical physics		79	65	38	43	43	24	22	7	2	323	3.1
Electron, atomic, molecular		149	144	106	112	83	79	49	24	25	771	7.4
Elem. particles		320	262	224	178	170	121	71	26	15	1 387	13.3
Geo/atmospheric physics		120	87	56	34	34	18	22	5	10	386	3.7
Mathematical physics		201	167	127	88	67	45	14	3	8	720	6.9
Nuclear physics		181	171	141	114	121	87	43	20	8	886	8.5
Optics		155	139	72	74	54	40	11	3	5	553	5.3
Plasma/fluid physics		105	97	90	53	64	43	35	12	12	511	4.9
Solid state		733	651	500	373	366	293	161	49	65	3 191	30.6
Engineering/applied		164	110	51	30	32	9	5	3	3	407	3.9
Other subfields		312	154	111	80	61	55	16	10	5	804	7.7

* The distribution of students in each subfield is based on 6442 respondents to this question.
** The total was derived from the Survey of Enrollments and Degrees.

Table IV. Sources of support for graduate physics students, by sex and degree status, 1982–83.

Source of support		Female	Male	Candidates for: Terminal master's	Master's enroute to PhD	PhD after master's	PhD only	Total N	Total %
Teaching assistantship		39%	33%	42%	43%	24%	32%	2122	33
Research assistantship		36	42	14	29	53	47	2675	42
Fellowship		9	8	3	7	8	12	543	8
Foreign government		1	2	2	2	2	2	133	2
Family, savings, loan		5	3	8	4	2	2	203	3
Part-time employment		2	4	9	4	4	1	229	4
Other, including multiple sources of support		8	8	22*	11	7	4	537	8
		100%	100%	100%	100%	100%	100%		
Total respondents	N	737	5705	650	1130	2538	2124	6442	
	%	11	89	10	18	39	33		100%

*Includes 18% who are full-time employed.

The level of graduate study and a student's candidacy for a specific degree are influential in determining sources of support for graduate study. First and second year students are likely to be offered teaching assistantships, whereas research assistantships are more prevalent among the advanced students. Since more women are terminal master's rather than doctoral candidates, **Table IV** shows that teaching assistantships are the dominant support for women graduate students, and that a larger proportion of women than men receive these assistantships.

The recent dramatic increase in foreign physics students prompted us to list a new source of support on the 1982–83 questionnaire, namely "foreign government". According to **Table IV** only 2% of the graduate students received financial support from their native countries. However, this percentage is expected to increase and may ultimately be an indication of how many graduates will be committed to return to their native countries for employment.

The normal pattern of graduate education in physics constitutes two years of course work followed by three or four years of research in an area of concentration which leads to a doctoral dissertation. The intensive professional work, which usually starts in the third year of graduate school, is performed either on an experimental or theoretical basis. An array of doctoral candidates, grouped by type of research, subfield and level of graduate study, is presented in **Table V.** The ratio of experimentalists to theoreticians is approximately 2:1, and none of the subfields reflects a major change in the porportion of students it attracts.

Table V. Number* of advanced graduate physics students specializing in selected experimental or theoretical subfields by years of graduate study completed, 1983–84.

Physics subfield	Type of research	Full-time equivalent years of graduate study: 3 yrs.	4 yrs.	5 yrs.	6 yrs.	7 yrs.	8 yrs.	>9 yrs.	Total N	Total % Exp.	Total % Theo.
Astrophysics	experimental	36	38	32	27	8	13	6	160	4.2	
	theoretical	53	14	23	23	8	2	2	125		6.7
Bio/medical	experimental	40	38	34	25	17	8	2	164	4.3	
Electron, atomic molecular	experimental	84	93	46	57	32	23	23	359	9.4	
	theoretical	31	20	21	17	15	2	–	106		5.7
Elem. particles	experimental	129	91	92	97	63	27	8	507	13.3	
	theoretical	101	90	66	25	6	–	4	292		15.7
Math. physics	theoretical	120	92	97	42	15	2	8	376		20.2
Nuclear	experimental	97	91	82	68	32	17	2	389	10.2	
	theoretical	57	23	18	23	11	2	6	140		7.5
Optics	experimental	55	65	40	30	10	–	6	206	5.4	
Plasmas	experimental	55	26	30	23	17	4	4	164	4.3	
	theoretical	46	25	34	13	15	6	8	147		7.9
Solid state	experimental	360	275	277	240	142	42	55	1391	36.5	
	theoretical	135	105	80	53	21	8	6	408		21.9
Other subfields	experimental	146	110	98	61	34	14	9	472	12.4	
	theoretical	81	68	58	33	19	8	1	268		14.4
Total	experimental	1002	827	731	633	355	148	115	3811	100.0%	
	theoretical	624	437	397	229	110	30	35	1862		100.0%

*The numbers in this table have been scaled up to reflect the total number of graduate students (5673) who completed three or more years of graduate study.

Table VI. Distribution by subfield and employment offers for doctorate recipients, 1982–83.

Physics subfield	Total in subfield	Employment-oriented graduates	New 'postdocs'	Percentage of graduates within subfield received: 0 offer	1 offer	≥2 offers
Astrophysics	5.7%	2.4%	3.3%	6%	45%	49%
Bio/medical physics	3.9	1.4	2.5	15	30	55
Electron, atomic molecular	10.4	5.0	5.4	6	56	38
Elem. particles	15.4	5.9	9.5	1	48	51
Math. physics	6.3	3.5	2.8	–	45	55
Nuclear	8.9	3.6	5.3	–	48	52
Optics	4.3	3.2	1.1	4	26	70
Plasmas, fluids	5.5	4.3	1.2	6	68	26
Solid state	31.1	18.2	12.9	6	44	50
All other subfields	8.5	7.6	0.9	9	49	42
Total %	100.0%	55.1%	44.9%	4%	47%	49%
Total N	898*	495	403			
All experimental subfields		355	278	5%	40%	55%
All theoretical subfields		140	125	2%	57%	41%

*This total does not include an estimated 23 graduates who were not interested in immediate employment, (see Figure IV). It is the Survey of Enrollments and Degrees which supplied this total.

Degree recipients

Taking into account the degree of specialization doctoral graduates require, it is not surprising that employment opportunities are more meaningful when expressed in terms of physics subfields and types of research. **Table VI** takes the doctorate recipients who are interested in immediate employment, shows their distribution by subfield, and distinguishes between two types of initial employment: as postdoctoral fellows or in potentially permanent positions. For each of nine major subfields **Table VI** shows what percentages of the graduates received employment offers. Though not a large subfield, optics graduates repeatedly have the highest percentage of multiple offers.

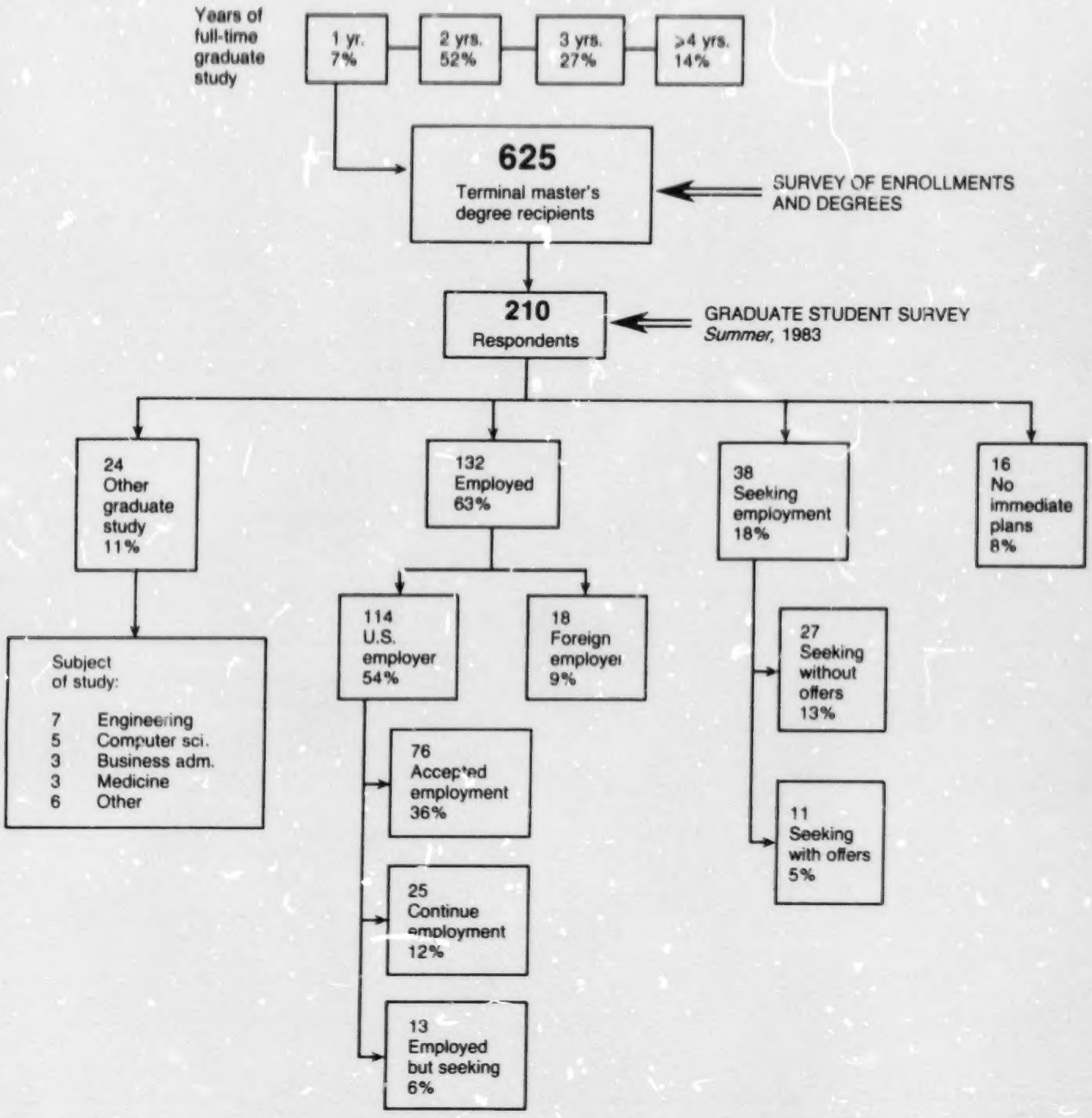
The percentages in the lower portion of **Table VI** represent a small shift toward new 'postdocs' and away from potentially permanent employment. However, a significant change from the previous year concerns the group of degree recipients without immediate employment offers. Only 2% of the theoreticians compared with 5% of the experimentalists were still seeking offers at the time of the survey. In the previous year the corresponding percentages were 7 for theoreticians and 4 for the experimentalists. This reversal can be attributed to the increase in foreign graduates who are more likely to be theoreticians and accept 'postdocs' without any delay. The "one offer" category increased by eleven percentage-points for theoreticians in the most recent year. Employment offers for the experimentalists indicate a five percentage-point shift from one offer to multiple offers between 1982 and 1983. As the foreign contingent among graduating classes increases, the questions concerning the postdegree plans of foreign graduates are beginning to find answers. A certain fraction of foreign graduates has always returned to their native countries upon completing physics doctorates in the United States, but it is still unclear at this time what legislation will be in effect in the coming years when the proportion of foreign degree recipients will be larger than it was in 1983.

An analysis of the type shown in **Table VII**, has been part of the Graduate Student Survey since the late 1970's, to form a basis for comparison. This table distinguishes between U.S. and foreign graduates and relates each group to U.S. or foreign initial employment. Back in 1978, 4% of the doctoral graduates were foreign citizens leaving the U.S. to accept initial employment; in 1983, this percentage increased to ten. The proportion of foreign graduates who find U.S. employers has not changed much in five years. Current legislation permits foreign degree recipients, who are in the U.S. on student visas, to accept 'postdocs' for up to two years without changing their legal status. **Table VII** reflects those circumstances because proportionately more foreign citizens than U.S. citizens accepted 'postdocs' from U.S. employers.

Table VII. Employment of doctoral graduates by citizenship, 1982–83.

Doctoral graduates	U. S. employer 'Postdoc'	U. S. employer Accepted	U. S. employer Cont.	Foreign employer 'Postdoc'	Foreign employer Accepted	Uncommitted	Total N	Total %
U.S. citizens	156	161	44	15	5	23	404	73
Foreign citizens	64	19	3	13	44	5	148	27
Total N	220	180	47	28	49	28	552	
Total %	40	33	8	5	9	5		100%

Figure III. Post-degree plans of physics terminal master's degree recipients, 1982–83.



By terminating graduate study in physics at the master's level, the student has the option of either continuing graduate work in another discipline or starting employment; over 80% fall into the latter category as shown in **Figure III.** The total number of terminal master's degrees granted in 1982–83 was 625, a total which apparently included considerably more part-time students than in the previous years. For example 77% of the masters who graduated in 1982 completed their degrees in at most two years; for the class of 1983, shown in **Figure III**, only 59% of the new masters fell into that category.

Table VIII. Distribution, by subfield, of employment offers for terminal masters, 1982–83.

Physics subfield	Total in subfield*	Percentage of graduates: within subfield received: 0 offer	1 offer	>2 offers
Astrophysics	5.2%	–	50%	50%
Electron, atomic, molecular	6.8	–	67	33
Elem. particles	4.9	25%	38	37
Engr. and applied physics	11.7	16	58	26
Geo. space physics	6.3	20	30	50
Nuclear	5.2	–	50	50
Optics	9.2	–	50	50
Solid state	21.8	15	62	23
General physics	13.6	16	63	21
All other subfields	15.3	26	35	39
Total	100.0%	16%	52%	32%
Employment-oriented respondents	170	27	88	55

*Based on 210 respondents.

Of the masters who transfer to "other graduate study", only a few of them chose a discipline unrelated to physics, such as business administration or theology. And the group that reported "no immediate plans" at the time of this survey, was found to include many who later chose part-time graduate work in an area closely related to physics. This information is obtained in a follow-up survey of all physics degree recipients.

A new feature, not included in earlier editions of this flow diagram of physics masters, is the distinction between U.S. and foreign employers. Although the proportion of foreign graduates among the physics masters is considerably smaller than that among the doctors, it has increased to 17% (from 11% five years earlier) and may increase further. Thus **Figure III** establishes a basis for comparison and shows a 6:1 ratio of U.S. to foreign employers for new masters; additional details are presented for graduates whose initial employment is in the United States. For example new masters who classified themselves as "employed but seeking" are probably not utilizing their physics training and consequently consider themselves still in the job market despite their current employment. The proportion of masters not yet employed rose from 11% in 1982 to 18% in 1983, a rise which can be attributed in part to foreign graduates who hope to get their student visas changed so as to qualify for employment in the United States. Included in the 18% who were not employed are 5% who had received employment offers but had not yet accepted any of them.

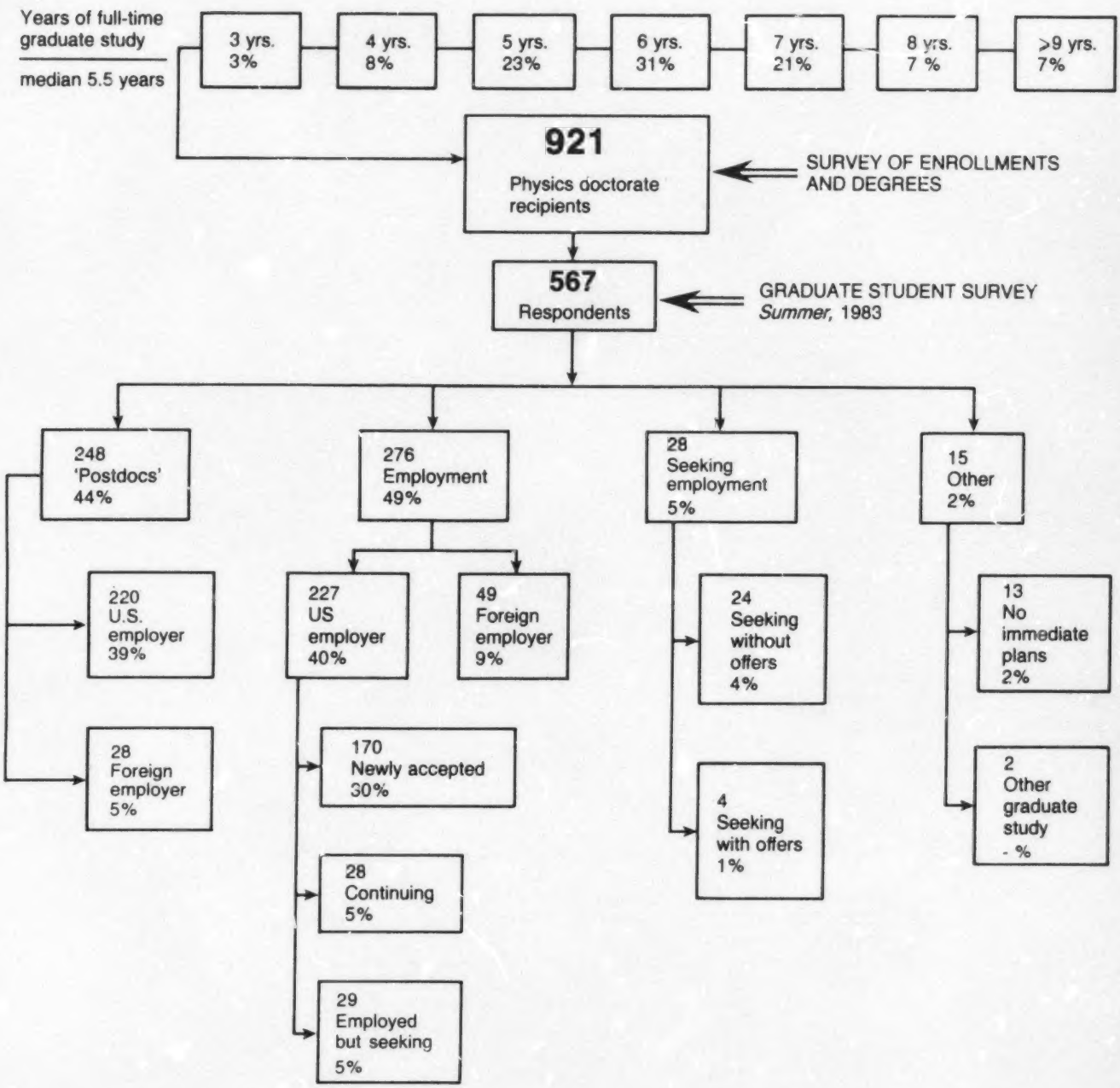
To offer greater detail on the "employed" and unemployed groups of **Figure III**, we constructed **Table VIII** which relates employment offers to the subfields those masters pursued in graduate school. Eight major subfields were chosen by 70% of the physics masters and all the graduates from four of those subfields had employment offers lined up shortly after graduation. Also shown in **Table VIII** is that almost one-third of the new masters reported multiple offers from employers.

Although we contact the degree recipients shortly after graduation, a majority of the new masters had already started their employment and were able to specify not only the type of employer but also the work activity. **Table IX** presents this information on 114 master's degree recipients and, as expected, industry remains the largest single employer. As in past years, few graduates work in computer science and the proportion that teaches appears to remain constant. Secondary schools do not generally attract many physics masters to their teaching staffs as shown in **Table IX.**

Table IX. Employment characteristics of 1982–83 recipients of master's degrees.

Work activity		Type of Employer: Sec. school	Coll.	Univ.	Industry	Gov't inc.mil.	Other	Total N	Total %
Teaching		7	4	6	–	–	–	17	15
Research		–	–	1	5	11	–	17	15
Res. and dev.		–	–	1	28	11	–	40	35
Engineering		–	–	–	26	2	–	28	25
Comp. science		–	–	3	1	2	–	6	5
Other		–	–	–	1	4	1	6	5
Total	N	7	4	11	61	30	1	114	
	%	6	3	10	54	26	1		100%

Figure IV. Background characteristics and post-doctorate status of 1982–83 physics graduates.



The flow diagram of **Figure IV** presents an overall picture of the physics doctorate recipients for 1982–83. For several years now, as foreign students comprise a larger portion of physics graduate students, we have anticipated an increase in the time required to complete a Ph.D. in physics. Although the 5.5-year median recorded for the class of 1983 represents only a minor prolongation of 0.2 from that observed in the previous year, increasing proportions of graduates were taking seven years or longer to complete their work.

The first of the four broad categories into which **Figure IV** divides the new physicists is the group of 'postdocs' whose number and distribution between U.S. and foreign employers is almost identical to that of the previous year.

More permanent postdoctoral commitments, reported by 49% of the respondents, single out those with U.S. employers to present additional details on the choices made. The 28 physicists who are "continuing" their employment which started before they completed their doctorates, had either secured suitably challenging positions while working on their dissertations, or anticipate appropriate promotions from their employers. The graduates who described themselves as "employed and seeking" are those who consider themselves in an interim position but are not on postdoctoral fellowships. The percentage of new physicists who were still seeking employment without offers at the time of the survey, remained at 4% where it was when the class of 1982 was outlined.

Table X. Use of physics in potentially permanent employment of graduate degree recipients, 1982–83.

	Major employer	Extensive use of physics training with respect to: method	subject matter	Number responding to question
Doctorate recipients	University	88%	92%	49
	College	86	88	17
	Industry	77	53	93
	FFRC	88	81	26
	Government	76	57	23
	Total	81%	68%	215

		Use of physics training with respect to subject matter: Extensive	Little	None	Number reporting
Terminal masters	Educational inst.	68%	32%	–	22
	Industry	49	49	2%	61
	FFRC/Gov't	55	38	7	30
	Total	55%	42%	3%	113

Since underemployment has always been a concern, graduates were asked to evaluate their initial employment in terms of the use they are making of their training. **Table X** summarizes the answers from both doctoral and master's graduates whose initial employment is potentially permanent. Distinguishing between utilizing research methods and subject matter is primarily meaningful where doctoral physicists are concerned, and, when reported in relation to major employers, more industrial and government physicists are using their research methods than their subject matter extensively. Terminal masters need to find employment in educational institutions to be assured of extensive use of their physics training. A majority of those employed in industry report making little or no use of their training in terms of subject matter.

Again in connection with the concern about underemployment, **Table XI** excludes 'postdocs', whose work is expected to be closely related to that of their dissertations, in order to focus attention on the work activities of doctorate recipients who accepted positions with potential permanence. The traditional work activities for doctoral physicists are research and teaching, and **Table XI** lists them both individually and combined to show that a majority of the new physicists are engaged in these work activities. The employers associated primarily with teaching and research are the educational institutions and the Federally Funded Research Centers. Their distribution in **Table XI** represents overall increases from those of previous years. In particular, the percentage of tenurable university positions showed the second annual increase; starting with 1981 the percentages are 7, 11 and 14.

Table XI. Initial employment with potential permanence for 1982–83 physics doctorate recipients

Work activity		Type of employer: University Tenurable	University Non-tenurable	Coll.	Industry	FFRC	Gov't	Nonprof. org.	Total N	Total %
Teaching		4	4	12	–	–	–	–	20	9
Research		5	10	--	19	18	6	6	64	28
Res. and teaching		23	6	8	–	–	2	–	39	17
Res. and dev.		–	3	–	58	7	14	–	82	36
Engineering		–	–	–	12	–	–	1	13	5
Other		–	–	–	9	1	2	–	12	5
Total	N	32	23	20	98	26	24	7	230*	
	%	14	10	9	43	11	10	3		100%

*Of the 276 doctorate recipients (see Figure IV) 46 did not specify both work activity and type of employer.

Table XII. Median monthly salaries paid by U.S. employers to new physics degree recipients, 1983.

Type of employer	Bachelor's degree recipients		Terminal master's degree recipients		Doctorate recipients			
					Percentage accepting:		Monthly starting salaries for:	
	Percentage accepting positions	Monthly starting salaries	Percentage accepting positions	Monthly starting salaries	'Postdocs'	Potentially perm. pos.	'Postdocs'	Potentially perm. pos.
Secondary school	4%	$1130	6%	$1550	–	–	–	–
College	1	1100	4	1650	–	4%	–	$1850
University	3	1380	10	**	35%	12	$1580	1990
Industry	53	1990	54	2390	3	21	2750	2990
Gov't inc. mil.	35	1440	18	2030	3	5	1940	2480
Fed. Funded Res. Ctr.	2	1750	8	2150	8	5	1780	2830
Other	2	1090	–	–	3	1	1650	2850
All employers	100%	$1670	100%	$2250	100%		$1650	$2760

**Fewer than ten graduates reported salaries.*

Starting salaries presented in **Table XII** include only those paid by U.S. employers for newly accepted positions. Hence the 28 physicists shown in **Figure IV** as "continuing" the employment they held while completing their doctorates, are not included. Doctoral physicists are divided into two groups because those starting potentially permanent employment are paid significantly higher salaries than those who accepted postdoctoral fellowships. For purposes of comparison, the starting salaries of physics bachelors were included in **Table XII** although they are not collected as part of the Graduate Student Survey. Thus the four salaries shown for the three levels of physics degrees place 'postdocs' and regularly-employed doctoral physicists once again at opposite ends of the salary scale. Their 1983 starting salaries correspond to 6% and 3% increases respectively. The salaries of physics masters registered a 5% increase over the previous year, and bachelors' salaries actually declined by 2% due to the large proportion who entered the military. Industry continues to pay the highest salaries, and even when sponsoring postdoctoral fellowships, industrial employers offer them at 67% above the median.

ASTRONOMY

The beginning of this report places the age of the survey of graduate astronomy students at almost ten years, during which time we found the astronomy students to be better respondents than the physics students. In 1983 almost three-quarter of the astronomy students contributed their information to this survey. Among the questions they answered were level of graduate study and subfields. **Table XIII** relates these two variables and includes astrophysics which is also listed among the physics subfields. By far the largest subfield is cosmology which attracts almost one-quarter of the graduate astronomy students. The distribution of students by level of graduate study is very similar to that of the previous year.

Table XIII. Graduate astronomy students* by subfield and years of graduate study 1982–83.

	Full-time equivalent years of graduate study						Total	
	1 yr.	2 yrs.	3 yrs.	4 yrs.	5 yrs.	>6 yrs.	N	%
Distribution of students	N	178	123	101	87	74	107	670
	%	27%	18%	15%	13%	11%	16%	100%
Astronomy subfields								
Astronomical instruments and techniques	9%	11%	8%	5%	5%	1%	45	7%
Cosmology, extragalactic objects, quasi-stellar objects	21	22	26	30	17	27	162	24
Galactic structure, stellar motions	7	9	7	4	13	5	48	7
Interstellar matter and gaseous nebulae	14	7	13	13	20	18	93	14
Solar system, space astronomy of the solar system	6	6	11	5	6	16	57	8
Stellar atmospheres and spectra, stellar evolution, solar and stellar interiors	10	17	12	16	13	16	93	14
Supernovae, X, γ and cosmic rays, pulsars	3	4	5	7	11	8	38	6
The sun	1	6	3	6	6	1	25	4
Astrophysics	20	9	8	10	2	4	64	9
All other subfields combined	9	9	7	4	7	4	45	7
	100%	100%	100%	100%	100%	100%	100%	100%

*The percentages shown in this table are based on 494 respondents to the Graduate Student Survey. Astronomy department chairpersons reported a total of 670 graduate students for the Survey of Enrollments and Degrees.

The characteristics of astronomy students listed in **Table XIV** are the same as those describing the physics students in **Table I**. Terminal masters were omitted from the table because only nine out of a possible 22 masters responded to the survey making comparisons problematic. Proportionately there have always been more women and fewer foreign students among the astronomers when compared with the physics population. And commitment to the profession is especially strong among the astronomy students as shown by what proportion are members of a professional society. Of the doctorate recipients 72% are members of a professional society compared with 53% of the doctoral physicists. Society membership for the other two groups shown in **Table XIV** is also higher than for the corresponding physics students.

Only 61 institutions offer an undergraduate degree in astronomy which is the reason why a majority of graduate astronomy students were physics majors in college. Another comparison worth noting is that a larger proportion of astronomy students than physics students were supported by fellowships.

Table XIV. Characteristics of the graduate astronomy student population, 1982–83.

Characteristics		All graduate students	First-year graduate students	Doctorate recipients
	*Total population:	670	178	81
	Number of respondents:	494	90	46
Sex	Female	14%	16%	13%
	Male	86	84	87
Citizenship	U.S.	82%	72%	89%
	Foreign	18	28	11
Professional society membership	AAS	32%	12%	63%
	Other	6	3	9
	None	46	68	14
	No response	16	17	14
Major of bachelor's degree	Astronomy	33%	25%	35%
	Physics	55	65	56
	Mathematics	4	2	7
	Other	8	8	2
Type of bachelor's institution	PhD-granting	62%	59%	60%
	MS-granting	7	5	11
	BS/BA-granting	15	13	20
	Foreign	16	23	9
*Type of graduate institution	PhD-granting	95%	87%	100%
	MS-granting	5	13	—
*Student status	Full-time	95%	95%	93%
	Part-time	5	5	7
Source of support	Teaching assist.	30%	48%	2%
	Research assist.	44	15	70
	Fellowship	14	21	11
	Employment	3	2	2
	Other	9	14	15

*These data were reported by astronomy department chairpersons as part of the Survey of Enrollments and Degrees.

Nota: Only 22 terminal master's degrees were granted and 9 responses received.

Figure V. Background characteristics and post-doctorate status of 1982–83 astronomy graduates.

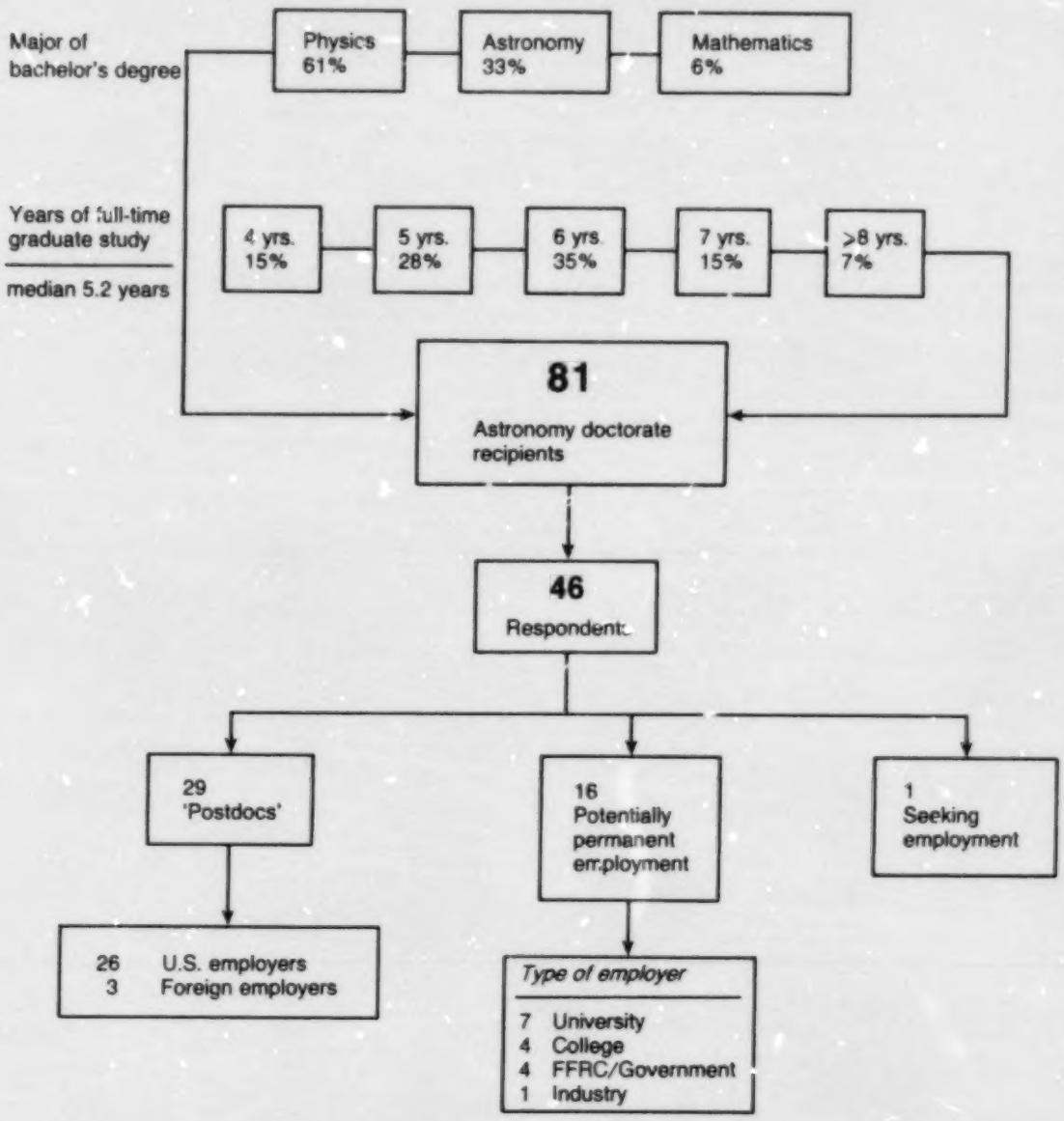


Figure V singles out the new doctoral astronomers and presents the background characteristics as well as their employment opportunities. The median number of years required to complete a Ph.D. in astronomy increased by two-tenths of a year, and the type of positions the respondents secured has hardly changed from the distribution reported in the previous year.